# STATEMENT OF WORK
# FOR THE DEPARTMENT OF COMMERCE
# NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

# COMMAND AND DATA ACQUISTION STATIONS AND SATTELITE OPERATIONS CONTROL CENTER SYSTEMS UPGRADE IN SUPPORT OF THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION – INITIAL JOINT POLAR SYSTEM PROGRAM


**29 October 2002**

**Prepared by**
**NOAA/NESDIS/OSD**
**5200 Auth Road**
**Suitland, MD 20746**

# DESCRIPTION/SPECIFICATIONS STATEMENT OF WORK

The Contractor shall provide all services, personnel, material, and equipment necessary to support the National Oceanic and Atmospheric Administration (NOAA) commitments to upgrade the Command and Data Acquisition (CDA) stations and Satellite Operations Control Center (SOCC) facilities and functions to support the Initial Joint Polar System (IJPS) program.

# 1.0 INTRODUCTION

NOAA has entered into an agreement with the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) for participation in the Initial Joint Polar System Program (IJPS). In the IJPS Agreement, NOAA and EUMETSAT agree to procure and operate their Polar-orbiting satellites in a manner beneficial to both parties and the world's meteorological community. This joint system will consist of two fully coordinated independent polar satellite systems, the NOAA Polar Orbiting Operational Environmental Satellite (POES) system and the EUMETSAT Polar System (EPS).

In support of IJPS, NOAA satellites NOAA N and N' will be flown consecutively (one replacing the other) in a polar orbit with an afternoon (p.m.) equatorial crossing time. EUMETSAT, working together with the European Space Agency (ESA) will develop the Meteorological Operational (Metop 1 and 2) series of satellites to be flown consecutively in a polar orbit with a mid-morning (a.m.) equatorial crossing time. These satellites will carry a set of jointly provided instruments. Instruments specific to each orbit will be provided by NOAA and EUMETSAT for their respective satellites. The agreement also commits NOAA and EUMESTAT to provide support to each other's operational satellite through their respective ground segments for commanding, receiving telemetry and acquisition of global data. IJPS services will begin when the first Metop satellite is commissioned, planned for the latter part of 2005. Initial NOAA-N support by the EUMETSAT CDA station will be available in early 2005.
POES ground system (PGS) must be upgraded in order for NOAA to support EUMETSAT's Metop satellites and use EUMETSAT's CDA for POES contacts,

## 1.1 Scope

This Statement of Work (SOW) applies to all CDA and SOCC functional tasks as specified in the Ground System Command and Data Acquisition and Satellite Control Center Requirements for the IJPS [AD-1] and interface requirements with other ground system elements as detailed in Section 3.2. Those requirements are applicable to this CDA/SOCC Upgrade (CSU) unless otherwise stated in the SOW. In the event of a discrepancy between the SOW and the Applicable Requirements the SOW shall take precedence. The CSU shall include the following functional areas:

- Program Management
- System Engineering
- System Design
- System Procurement

- System Integration
- System Verification and Validation
- System Operations Training
- Sustaining Engineering
- Deliverables

## 1.2 Background

The National Environmental Satellite, Data, and Information Service (NESDIS) within NOAA is responsible for operating the U.S. Environmental Satellite Programs. As part of this responsibility, NESDIS manages the POES system and the Defense Meteorological Satellite Program (DMSP) system.

The command and control of NOAA satellites, data and product distribution, and data storage are supported by the PGS. This system includes the SOCC and Central Environmental Satellite Computer System (CEMSCS) located at Suitland Maryland, the NOAA CDA stations located at Wallops, Virginia (WCDA) and Fairbanks, Alaska (FCDA), and the satellite data access and archive centers.

The SOCC is responsible for the health and safety of the spacecraft and instruments. The CDA stations' primary mission is to satisfy command and telemetry, data transmission, and data acquisition requirements. Polar orbiting satellite operations are conducted using the Polar Acquisition and Control Subsystem (PACS). PACS is a multifunctional computer based real-time command and control system. PACS processes and displays spacecraft health and safety telemetry for operator monitoring, generates commands for control of the spacecraft subsystems and ground equipment, and provides several non-real-time functions such as data archiving and trending. Operators conduct commanding and data acquisition by using an automated schedule running on PACS that is generated by the Satellite Operations Management Subsystem (SOMS). The schedule is also used to configure the CDA and SOCC ground equipment in conjunction with spacecraft activities.

The Fairbanks CDA consists of three 13-meter antennas each with L/S Band simultaneous transmit/receive capability and a simultaneous X-Band receive capability. A separate VHF receive only antenna can be slaved to any one of the 13-meter antennas.

The Wallops CDA consists of two 13-meter antennas and a 14.2-meter antenna each with L/S-Band simultaneous transmit/receive capability. The 13-meter antennas also have a simultaneous X-Band receive capability. Additionally, the 14.2-meter antenna is capable of receiving VHF. Back-up S-Band transmit capability for the 14.2-meter is provided by a slaved 4-meter antenna.

The current NOAA POES Ground Segment (PGS) elements including the SOCC and Command and CDA stations are further defined in reference documentation available in the NOAA Office of Systems Development (OSD) Library.

# 2.0 DOCUMENTS

**Table 2-1 Applicable Documents**

| Doc# | Title | Reference Number | Issue | Date |
|---|---|---|---|---|
| AD-1 | Ground System Command and Data Acquisition and Satellite Control Center Requirements for IJPS | NOAA-POES/OSD 2001-0010R0UD0 | 1 | 07/02 |
| AD-2 | IJPS Key Milestone Schedule | EUM.EPS.MAN.PLN. 00.011 | 1.1 | 05/01 |
| AD-3 | EPS/NOAA Joint Operations Rules and Procedures | NOAA-POES-IJPS/OSD-2001-0004R0UD0 | 1.0 | 11/01 |
| AD-4 | NOAA GS Interface Specification | EPS-ASPI-IR-0260 Draft/Upon Request | 3B | 9/02 |
| AD-5 | Metop Space to Ground Interface Specification | MO-IF-MMT-SY0001 | 5 | 10/00 |
| AD-6 | CDA/SOCC Upgrade to Ingest and Preprocessing System Interface Requirements Document | NOAA-POES-IJPS/OSD-2002-0016R0UD0 | 1 | 10/02 |
| AD-7 | NOAA IJPS Communications Requirements | NOAA-POES/OSD-2001-0006R0UD0 | Final | 12/01 |
| AD-8 | NOAA/NESDIS Document Control Procedure | NOAA/OSD3-1999-0035R0UD | DCN0 | 11/99 |
| AD-9 | General Requirements For Ground Requirements For Ground Electronic Equipment | NESDIS NO. S24.802 | Revised | 04/97 |
| AD-10 | Cable And Wire Identification | NESDIS NO. S24.803 | Revised | 03/97 |
| AD-11 | General Requirements For Training On Electronics Equipment | NESDIS NO. S24.804 | Revised | 06/99 |
| AD-12 | Software Development, Maintenance, and User Documentation | NESDIS NO. S24.806 | Revised | 04/94 |
| AD-13 | NOAA/NESDIS Ground Systems Configuration Management Plan for Satellite Operations | NOAA/OSD3-1997-012R1UD0 | Rev 1. | 02/98 |
| AD-14 | NOAA/NESDIS Man-Machine Interface (MMI) Standards | NESDIS NO. S24.807 | Revised | 08/88 |
| AD-15 | Software Requirements Specification for the Polar Acquisition and Control System | ISI-169-24 | Rev A | 12/90 |

**Table 2-2 Reference Documents**

| Doc# | Title | Reference Number | Issue | Date |
|---|---|---|---|---|
| RD-1 | NOAA Baseline Polar-orbiting Operational Environmental Satellite (POES) Command and Data Acquisition (CDA) and Satellite Operations Control Center (SOCC) Equipment Configuration | NO-IJ/SO-99-0008R0U0 | #2 | 11/99 |
| RD-2 | POES Ground Segment Upgrade Description for IJPS | NO-IJ/OSD-00-0005-R0UD0 | # 1a | 05/00 |
| RD-3 | POES Concept of Operations | NOAA-POES/OSD-1-2001-001R0UD0 | DCNO | 02/01 |
| RD-4 | Satellite to Ground Interface (NOAA-N&N') | LMAS IS 23033284 | | 08/00 |
| RD-5 | EPS Core Ground Segment Interface Requirements on NOAA Ground Segment | NOAA-POES-IJPS/OSD-2001-0002R0UD0 | # 2.2 | 11/01 |
| RD-6 | NOAA Interface Requirements on EPS Core Ground Segment | NOAA-POES IJPS/OSD-2001-0003R0UD0 | #2.2 | 11/01 |
| RD-7 | NOAA POES Master V&V Plan For IJPS | NOAA-POES-IJPS/OSD-2002-008R0UD0 | Draft | 09/02 |

# 3.0 PERFORMANCE REQUIREMENTS

The Contractor shall provide services as described below to upgrade the SOCC and the CDAs to support the IJPS. The Contractor shall have the knowledge (or a plan to acquire the expertise) of NOAA's procedures and methodology of the POES Ground Systems. This effort is dependent upon coordination and cooperation among the IJPS CSU Contractor, NOAA, and other NOAA Contractors. Successful performance requires the Contractor to work in the confines of the IJPS schedule. The Contractor shall be International Organization for Standards (ISO)-9000 Quality Management and Quality Assurance certified.

## 3.1 Project Management

The Contractor shall perform all the program management functions including technical and business management functions that are necessary to execute the total effort required by this contract. The Contractor shall designate a program manager to coordinate day-to-day activities and to act as the technical interface with the Contract Technical Representative (COTR). The program manager or designated representative shall be directly responsible to coordinate and manage the following tasks:

- Technical Interchange Meetings (TIMS)
- Preliminary Design Review (PDR)
- Critical  Design Review (CDR)
- Coordination Meetings
- Monthly Program Status Report

The Contractor's program management function shall also encompass the management functions addressed in the following paragraphs.

### 3.1.1 Contract and Cost Management

The Contractor shall provide the contractual and cost management efforts necessary to efficiently work with the Government in the design, implementation, integration, testing, and training activities required to execute the CSU contract.

### 3.1.2 Technical Progress Reporting

The Contractor shall submit a written Monthly Program Status Report (A1) to NOAA. The following items shall be included in each status report unless other agreements are made between the Contractor and NOAA:

- Summary (accomplishments, overall status of all tasks)
- Financial (include man-power utilization)
- Schedule (updated monthly)
- Planned Activities
- Issues and Concerns (include risk and mitigation strategies)

### 3.1.3 Scheduling and Coordination

The Contractor shall establish, maintain, and control a detailed schedule that shows the order in which work will take place, including identification of major events and milestones and shall cover the period of performance (POP).  The schedule shall also coordinate with the milestones established for the IJPS.
The schedule shall include:

- Engineering activities including design reviews and TIMs
- Software development
- External dependencies
- Installation at each site
- Software integration
- Testing
- Training
- Documentation

The Contractor shall provide to NOAA an assessment report, a mitigation plan, and the schedule and cost impact of any changes to contract deliverables and scheduled milestones.

### 3.1.4 Web Based Project Information

The Contractor shall implement a project information centralized web page within 30 days after contract award. The web page shall be maintained throughout the life of the contract. The contractor shall make available on the web page all review and final delivery documentation such as drawings, technical manuals, training materials, TIM minutes, correspondence, schedules, PDR and CDR presentation materials, and other deliverables as noted in Table 4.1. The web page shall be password protected and accessed only by authorized personnel.

### 3.1.5 Configuration Management

The Contractor shall prepare a Configuration Management (CM) Plan (B1) for approval. The CM Plan shall include a schedule that lists items to be controlled during the design, development, installation, and testing of the CSU for IJPS. The CM Plan shall also provide details of the process used to control the configuration and manage changes to the following items:

- System design
- COTS hardware, firmware, and software
- Custom developed hardware and software
- Firmware present in the architecture
- Documentation of the system
- Facility modifications
- Test procedures
- Any special test tools

The CM plan shall follow the standards specified in the [AD13]. The Contractor shall coordinate with the NOAA CM office for delivery of the contract deliverable requirements list (CDRL) items, shown in Table 4.1.

### 3.1.6 Quality Assurance

The Contractor shall establish and conduct a Quality Assurance (QA) program. The Contractor shall provide the Quality Assurance Plan (QAP) as part of their proposal. The plan shall be implemented at contract award and continue throughout the life of the Contract. The plan shall consist of sequential inspections and progressive Quality Control throughout the development cycle. The Plan shall detail methods for documenting defects, providing for timely correction of deficiencies, identifying deficient areas, and recommending solutions to systemic problems. The plan shall assure that the quality of all items presented to the Government meets the requirements of the specifications, whether manufactured or processed by the Contractor, or procured from subcontractors or vendors.

The plan shall be totally integrated into all areas of the Contractor's development and operation, both technical and administrative, including design and production. The plan also applies to all tests required by this SOW.

If, during the POP, modifications to the QAP are proposed for any reason, the Contractor shall submit the changes to the Government for approval. The submission schedule shall allow sufficient time for Government review and comment prior to implementation.

The personnel assigned to the development, administration and daily functions of the QAP shall be fully trained in their areas of responsibility which may include: instruction and procedure development, product quality monitoring, inspection techniques, and inspection data management and analysis. The personnel assigned to quality assurance functions shall have sufficient, well defined responsibilities, independent authority and organizational freedom to identify and evaluate quality problems and to initiate and recommend timely and positive solutions. Timely notice shall be given to the Government of personnel changes that affect the overall operation and internal reporting requirements of either the Quality Assurance organization or its assigned personnel.

Documentation which demonstrates that the Contractor has accomplished Quality Assurance inspection shall be maintained and be made available to the Government prior to presentation for preliminary acceptance. The inspection and test documentation shall clearly describe the type of test or inspection to be accomplished with acceptance and rejection criteria. The documentation shall list the quantity and type of deficiencies found and the nature of corrective action taken.

The QAP shall address the certification and re-certification, use, cataloging and maintenance of measuring and test equipment. It shall address those pieces of equipment which will be used or installed to assure that the standards established in the required tests or inspections are met.

Where quality assurance process standards are established by other organizations and are to be used on this contract, those standards shall be provided to the Government for information. Updates to the standards shall be provided as they are approved.

The QAP shall establish and maintain an effective and positive control of non-conforming supplies or products, including procedures for identification, segregation, presentation and disposition of rework or repaired supplies or products.

The establishment and implementation of a QAP by a subcontractor or vendor does not relieve the Contractor of its responsibility to furnish to the Government items which fully comply with the requirements of the Contract.

The Contractor, in performance of this contract, shall conduct audits of the developing products. The QAP shall describe the audit procedures to be used, it shall identify the documents to be audited, the type of audit to be conducted (walk-thru, inspection, validation, etc.), the number and frequency of audits, and the proportionate size of the sample to be audited.

### 3.1.7 Risk Management

The Contractor shall identify risks and provide a mitigation plan for critical path items in a timely fashion. As there are concurrent POES Ground System development initiatives, coordination of baseline products across contracts is imperative. The monthly reports shall reflect the latest risks and mitigation strategies.

## 3.2 Command and Data Acquisition Stations/Satellite Operations and Control Center Requirements

The SOCC and CDA integration and implementation shall meet the SOCC and CDA security requirements and provide the capability to support operations in accordance with the EPS/NOAA Joint Operations Rules and Procedures [AD-3]. The Contractor shall design and implement all CSU specified in the Ground System Command and Data Acquisition and Satellite Control Center Requirements for the IJPS [AD-1] and CDA/SOCC Upgrade to Ingest and Preprocessing System Interface Requirements Document [AD-6]. The SOCC and CDA shall interface with other PGS elements via the Communications Element in accordance with the NOAA IJPS Communications Requirements [AD-7]. The SOCC and CDA shall interface with EUMETSAT according to the interfaces defined in the NOAA/EPS Ground Segment Interface Control Document [AD-4].

The following sections describe a high level overview of the changes needed to the SOCC and CDAs to support the IJPS environment. For more information refer to:

- NOAA Baseline Polar-orbiting Operational Environmental Satellite (POES) Command and Data Acquisition (CDA) and Satellite Operations Control Center (SOCC) Equipment Configuration [RD-1].
- POES Ground Segment Upgrade Description for IJPS [RD-2].
- POES Concept of Operations [RD-3].
- Satellite to Ground Interface (NOAA-N&N') [RD-4].
- EPS Core Ground Segment Interface Requirements on NOAA Ground Segment [RD-5].
- NOAA Interface Requirements on EPS Core Ground Segment [RD-6].

### 3.2.1 Command and Data Acquisition Stations/Satellite Operations and Control Center Upgrades

The CSU shall not impact the capability of the Polar Ground Segment (PGS) to meet existing POES System Requirements. The CSU shall support continuous 24 hour a day, seven days a week operations. The Contractor's design shall integrate the new functions with the current operations. The design shall not require the Government to increase operational personnel or increase the operator's workload.

### 3.2.2 Command and Data Station Upgrades

FCDA and WCDA shall provide the capability to monitor the real-time state of health telemetry and generate uplink commands for the new instruments on N and N'. Additional capabilities are required to support the Metop satellites. The Fairbanks CDA

shall be capable of providing support to the Metop Satellites in accordance with the Metop Space to Ground Interface Specification [AD-5] when requested by EUMETSAT.

The following is a list of new capabilities needed at FCDA to support this requirement for IJPS but not limited to:

a. Auto tracking of X-band signals during Metop passes
b. Demodulation of the Metop Global Data Stream (GDS)
c. Bit Synchronization of the GDS data stream
d. Frame Synchronization of the GDS data stream
e. RF modulation of the Metop command uplink
f. Demodulation of the Metop telemetry (TM) stream
g. Bit Synchronization of the Metop TM stream
h. Frame Synchronization of the Metop TM stream

GDS is downlinked from the Metop satellites in Consultative Committee for Space Data Systems (CCSDS) format. The FCDA shall de-randomize and Reed-Solomon decode the GDS, determine the resulting quality and time stamp the data with a Universal Time Code (UTC). The UTC time stamp and quality flag shall be appended to the GDS data that is provided to the Communications Element to be forwarded to Suitland. The Metop telemetry is time-stamped and sent to Suitland in real-time. SOCC shall receive the EUMETSAT requests and schedule the FCDA resources. FCDA shall maintain as a minimum a seven-day rolling archive of all GDS data received from Metop satellites.

The EPS Core Ground Segment shall bent-pipe commands to the Metop satellites using the FCDA. The FCDA shall have the capability to uplink the command bit stream to the Metop satellites. The FCDA shall acknowledge receipt of Metop commands and return an Acknowledgement (ACK) via the Communication Element.

NOAA shall collect and process Metop High Resolution Picture Transmission (MHRPT) data during the period when the Metop satellite is visible from either the Wallops or Fairbanks CDA stations. Both CDAs shall be modified to acquire MHRPT data and extract a subset of VCDUs to be sent to the Ingest and Preprocessing System (IPS). MHRPT is an L-Band transmitted QPSK 3.5 Mpbs bit stream. Data is received for the complete duration of the CDA acquisition window. Needed capabilities by both CDAs are as follows but not limited to:

i. Auto-tracking of L-band signals during Metop passes
j. Control tracking of antennas during Metop passes
k. Demodulation of the MHRPT data stream
l. Bit Synchronization of the MHRPT data stream
m. Frame Synchronization of the MHRPT data stream

MHRPT data is in CCSDS format. FCDA and WCDA will Viterbi decode, de-randomize, and Reed-Solomon decode MHRPT data and forward selected VCDUs to IPS.

The current capabilities at the CDAs to configure, control, and monitor hardware and software processes must be extended to cover IJPS hardware and software.
In the IJPS era, the WCDA serves as the Backup SOCC. As such the WCDA capabilities will include as follows, not limited to:

n. Coordination with Core Ground Segment (CGS) for IJPS POES cross support
o. Commanding POES through the Darmstadt interface
p. Receiving POES state of health telemetry from the Darmstadt interface
q. Receiving POES command echoes from the Darmstadt interface

### 3.2.3 Satellite Operations Control Center Upgrades

SOCC's responsibilities for the IJPS POES satellites (NOAA N and N') are the same as it is for the current POES satellites. Additional SOCC capabilities are required to support NOAA N , N', and Metop satellites and use EPS resources for IJPS POES satellites. Three to four passes a day shall utilize the EUMESTAT CDA and CGS. Other cross support contacts can be coordinated with EUMETSAT when needed.

The SOCC shall have the capability to exercise POES command and control functions using the NOAA CDA or the EPS CDA resources. Telemetry and global data down-linked during the EPS CDA passes shall be delivered to the Darmstadt interface and transported by the NOAA Communication Element to Suitland. The SOCC shall command through the Darmstadt interface and EPS CDA during such satellite contacts.

The SOCC shall be modified to process telemetry, monitor health and safety, trend and archive the telemetry, schedule instrument operations and generate and format commands for the N and N' satellites. Specifically, modifications are required to decommutate and display the new Microwave Humidity Sounder (MHS) instrument, MHS Interface Unit (MIU) data, and process spacecraft Ascent Mode CPU telemetry during the Ascent phase. These modifications shall also be made to FCDA and WCDA. SOCC shall be capable of providing POES MHS telemetry to the CGS.

SOCC monitor and control functions must be extended to support IJPS-unique equipment, software, and communication resources. SOCC must be able to control FCDA and WCDA antenna acquisition in support of the Metop satellites. The Contractor shall provide NOAA a plan detailing how SOCC will monitor the quality of the MHRPT data received at FCDA and WCDA.

SOCC Operations will be moving to a new location in the future. The Contractor shall anticipate in the design enough redundancy to allow continuous operations during the transition period from the old building to the new building.

### 3.2.4 Option:
### Satellite Operations Management System Modifications

In addition to the current scheduling capabilities the SOCC will schedule IJPS POES passes utilizing the EPS CDAs, MHRPT collections at both FCDA and WCDA, and

Metop full service support contacts at the FCDA. SOMS shall have the capability to schedule Svalbard as a station for telemetry, command, and Global Area Coverage (GAC) or Stored AMSU Information Processor (SAIP), or Stored Tiros Information Processor (STIP) dumps. SOCC does not control any of the Svalbard ground station resources. The Svalbard ground station resources are controlled by EUMETSAT. Stored Command Tables for the IJPS POES satellites must reflect Svalbard contacts. NOAA CDA command level schedules must also reflect Svalbard contacts. Command level schedules must reflect the Metop and IJPS POES passes at both NOAA CDA stations. SOMS shall be able to schedule the SOCC and CDA equipment to support Metop contingency operations at FCDA including acquisition of GDS. The SOCC shall provide the capability to work in close coordination with EUMETSAT to plan and schedule joint satellite operations.

Additionally, SOMS shall be able to support the full functionality of the Digital Data Recorders on the IJPS POES satellites.

## 3.3 Engineering

### 3.3.1 Requirements Definition

The Contractor shall be responsible for conducting a formal requirements analysis effort. The Contractor shall use the DOORS requirement tool for requirement tracking and traceability. Access to the DOORS tool is provided by NOAA. Once the requirements are baselined, the CSU Contractor shall maintain trace-ability of the requirements into the test procedures and shall track changes to the requirements. Any Contractor initiated changes to the base-lined requirements shall be submitted to NOAA for review and approval.

The Contractor shall be responsible for conducting Technical Interchange Meetings (TIM). The purpose of these meetings is to review and address all open issues associated with design implementation and integration of the CSU. The Contractor shall provide Meeting Minutes (C1) of the TIM to NOAA.

The Contractor shall provide a SOCC, CEMSCS Interface Control Document (ICD)(D1), CDA,CEMSCS ICD(D2), and SOCC, CDA ICD(D3). Preliminary copies of the ICDs shall be provided at the Preliminary Design Review (PDR) with interim updates provided at the Critical Design Review (CDR). The final ICDs shall be delivered 30 days after the completion of the final Acceptance Test. These ICDs shall define the functional and physical design of each interface including precise data content and format for each data flow.

### 3.3.2 Design

The CSU design shall follow the general requirements identified in the NOAA/NESDIS General Requirements For Ground Requirements for Ground Electronic Equipment [AD-9]. The Contractor shall present design detail at the Preliminary Design Review, the Critical Design Review, and as needed, at the Technical Interchange Meetings.

### 3.3.2.1 Technical Interchange Meeting

The Contractor shall provide a Design TIM detailing the PGS modifications necessary to support the NOAA-N and N' satellites in accordance with the NOAA-N launch schedule. The Contractor or the COTR may request a TIM to facilitate development activities and clarify interpretation of CSU requirements. The COTR will be responsible for designating the subject, time, and place of such meetings and assure the availability of appropriate Government personnel.

### 3.3.2.2 Preliminary Design Review

The Contractor shall perform a design effort culminating in a formal PDR. The PDR will be the first major review of the detailed design and may require a site survey. This review shall show the high level design of the system, mapping the system requirements to a preliminary System Description Document (SDD) (E1). The SDD shall be delivered two weeks before PDR. The COTS trade-studies shall be documented in the COTS Selection and Evaluation Report (G1). Human computer Interface design shall follow the standards set forth in the NOAA/NESDIS Man-Machine Interface (MMI) Standard [AD14]. Design considerations shall be given to minimize the Operator Human Computer Interface (HCI) loading by the CSU. An Analysis shall be performed by the Contractor to determine that the Operator HCI will not impact current operations and will not result in a significant operator workload increase. This will result in an Operator Human Computer Interface (HCI) Analysis report (M1).

The Preliminary Design Review shall also at a minimum include:

- System overview
- General architecture with proposed hardware and software modules at a high level, to include functional flow, and requirements allocation data for the system.
- Equipment layout drawings and preliminary drawings, including any proprietary or restricted design/process/components and information.
- Description of Development and support tools.
- Safety and security engineering considerations
- Preliminary lists of materials, parts, and software
- Environment control and thermal design aspects
- A detailed schedule
- COTS trade-studies

The following Contract Deliverables shall be delivered at PDR:

- Operator Human Computer Interface (HCI) Analysis
- Configuration Management Plan (B1)
- Preliminary CSU System Verification Test Plan (F1)
- COTS Selection and Evaluation Report (G1)
- Preliminary System Deployment and Installation Plan (H1) for SOCC and CDA

- Preliminary Operations and Maintenance Support Plan (I1) for SOCC and CDA
- Preliminary Software Transition Plan (K1)
- Preliminary ICDs (D1,D2,D3)
- Preliminary PDR Presentation (O1)
- Final PDR Presentation (O2)
- Preliminary System Description Document (SDD) (E1)

All Plans shall include the appropriate drawings. The PDR review process is intended to serve as an interim step in the design process where NOAA and the Contractor agree that the design is proceeding as planned and meets the requirements.

### 3.3.2.3 Critical Design Review

The CDR shall represent a complete and comprehensive presentation of the entire design for the CSU. The CDR shall describe the functional software modifications with supporting rationale. All details of which modules will be written, reused, or Commercial Off the Shelf (COTS) shall be clearly identified. In the SDD requirements shall be mapped down to the module level. The CDR shall present the refined system hardware architecture in sufficient detail with supporting rationale (including trade-off studies) to allow Government authorization for material procurement. Product and System Safety, Problem Areas, and Security Issues shall all be items discussed at the CDR.

Completion of the CDR and resolution of all the action items generated by it constitutes the baseline design for the CSU. Drawings shall be released and formal configuration control initiated no later than the date of the CDR.

The Critical Design Review shall also include:

- Final system design detail to include
  - New hardware and software modules
  - Identification of modified software processes and modules
  - Storage control and allocation
  - System performance estimates
- Final and updated equipment layout drawings, including any proprietary or restricted design/process/components and information.
- Description of development and support tools updated from PDR.
- Final safety and security engineering considerations
- Final list of materials, parts, and software
- Final environment control and thermal design aspects
- Updated milestone schedule

The following Contract Deliverables shall be delivered at CDR:

- Final System Deployment and Installation Plan (H1)
- Final Operations and Maintenance Support Plan (I1)

- Interim Updates to the ICDs (D1,D2,D3)
- Final Software Transition Plan (K1).
- Training Class Plan (J1)
- System Description Document (SDD) (E1)
- Final CSU System Verification Test Plan (F1)
- COTS selection and Evaluation results report (G1)
- Preliminary CDR Presentation (P1)
- Final CDR Presentation (P2)

Completion of the CDR and resolution of all action items generated by the CDR constitutes the baseline design for the CSU.

### 3.3.3 Hardware Support and Procurement

Hardware engineering support shall be provided to establish the baseline hardware configuration, to obtain all required CSU equipment, and to install, test, and maintain the equipment. The Contactor shall provide justification for all equipment procured. The justification shall allocate requirements to the equipment procured. The Contractor shall perform a trade study that evaluates the COTS hardware selections. The Contractor shall present the selection justification at the PDR and/or CDR and provide a COTS Selection and Evaluation Report (G1). The Contractor shall obtain Government approval of the COTS selection prior to any procurement of hardware. Once received from the vendor, the equipment shall be integrated and tested.

The Contractor shall use in-house quality control procedures and personnel to ensure that the delivered equipment is fabricated in accordance with best commercial practices and has successfully passed all in-house testing. NOAA reserves the right to request copies of quality control fabrication and test reports. All installed cabling and wiring shall comply with the NOAA/NESDIS Cable and Wire Identification Standard [AD-10]. The equipment shall be designed for continuous operation (24 X 7) with minimal maintenance requirements. Satisfaction of the reliability, maintainability, and availability requirements shall be a prime consideration in the selection, purchase, or design of equipment.

All potential hazards to operating and maintenance personnel are to be minimized or eliminated by the unit's design. All installation work shall be performed in accordance with applicable codes and ordinances, and in a manner that does not interfere with other operational systems that may be collocated at the site. The Contractor shall provide all items necessary to ensure proper operation of all equipment provided.

The provided equipment shall cause no electromagnetic (emitted or conducted) interference-related negative effects on nearby information technology, radio frequency emitters, telecommunications, or other electronic equipment located at the SOCC or CDA stations. Reasonable effort shall be made to limit voltages and currents occurring during fault conditions. Voltages shall be kept below the dielectric breakdown strength and current kept below the maximum capabilities of the system and its components.

### 3.3.4 Software Implementation

All new and updated software shall be developed in accordance with the Software Development section of the NOAA/NESDIS Software Development, Maintenance, and User Documentation [AD-12]. This effort will maximize the re-use of existing code and preserve functionality and file format to minimize operational impact. All new software modules will contain a standard prolog.
Modified modules will include programmer name, date, and reason for change. This applies to all software that is adapted from the existing system, and to Contractor-developed software.

The PACS Development Rail will be available for developing and testing software changes. CSU shall not impact the current operational baseline (Refer to Software Requirements Specification for the Polar Acquisition and Control system [AD-15].

The PACS Development Rail will be available for developing and testing software changes. CSU shall not impact the current operational. The Contractor shall follow the PACS Configuration Management software procedures for all software upgrades.

## 3.4 Security

The Contractor shall apply Information Technology (IT) communication security requirements for all implementation of the design. For reference use the NOAA IT Security web pages for laws, statutes, and regulations on the URL:https://www.csp.noaa.gov/policies/index.html.

The security aspects of the CSU shall be included in the System Life Cycle Development methodology and are required to protect the systems, network, and data in accordance with the Federal information security laws and regulations that focus on the confidentiality and integrity of data, and the availability of the system and its data. The CSU shall contain sufficient security measures to meet the existing NOAA and NESDIS Information Technology Security Policy.

The CSU Contractor shall participate in the Security working group that will meet to discuss security issues of the POES system. Other members of this working group are the COTR, OSD, a security representative from Office of Satellite Operations (OSO), and Aerospace and Mitretek Systems (MTS).

### 3.4.1 Operational LAN Protection

The CSU shall not in anyway compromise the security of the SOCC operational LANs. No direct connection from EUMETSAT shall be possible with the operational LAN.

### 3.4.2 Monitor and Control

The CSU shall grant access to SOCC and CDA systems based upon user account privileges.

### 3.4.3 User Log

The CSU shall maintain a log of all (successful and unsuccessful) entry attempts. An entry attempt is any request to access SOCC and CDA resources by anyone.

### 3.4.4 Suspicious Network Activity

The CSU shall detect suspicious network activity and incorporate a reporting mechanism to alert the network manager. Example of suspicious network activity includes attempts to gain access to the SOCC or CDA system by masquerading as users, applications, network operating system requests, or network devices.

### 3.4.5 Firewall

The CSU shall have a firewall to protect against unauthorized access. The SOCC Upgrades shall provide e-gap technology to protect the external interfaces as needed.

## 3.5 CSU Verification and Validation

The CSU Contractor shall develop a CSU System Verification Test Plan (F1), Acceptance Test Procedure (F2), and Acceptance Test Reports (F3).
These will be distributed to the government for approval. The verification plan shall include a CSU requirements verification matrix. The test plans, procedures, and reports shall use the NOAA POES Master Verification and Validation Plan [RD-7] as a guide. The Contractor shall provide the capabiltiy for PACS to support the NOAA-N/N' end-to-end testing activities beginning in September 2003. This support includes MHS/MIU real-time telemetry processing and display, MHS/MIU command functionality, MHS/MIU command load generation functionality, and processing the Ascent Mode CPU telemetry. The Contractor shall support the NOAA/EPS initial interface testing with a minimal amount of equipment, supportive documentation, and reports by March 2004.

First article testing and preliminary interface testing with simulated data or satellite simulator shall be conducted to minimize the risks. The Metop Satellite S-Band and X-Band suitcases will be provided by EUMETSAT. Refer to the IJPS Key Milestone Schedule [AD-2] for the availability of these suitcases. The Metop Satellite S-Band and X-Band suitcases shall be used to test the RF interfaces at FCDA. The S-Band RF Suitcase shall also be utilized during the joint EPS/NOAA end-to-end testing. Tests to verify the RF space to ground interface shall be performed at WCDA and FCDA.

### 3.5.1 Developmental Test

Developmental testing shall be performed by the Contractor on major functional areas, but not necessarily within the context of the fully integrated system. The Contractor shall ensure that software unit testing addresses unit level sizing, timing, and accuracy requirements. Unit testing may demonstrate general or specific requirements. Tests plans and procedures will describe how, when, and from where the test-unique support

items will be obtained and NOAA will be notified if GFE is needed. The Contractor shall provide test schedules consistent with higher level plans.

### 3.5.2 Integration Test

The Contractor shall perform end-to-end system integration testing. The test plans shall include the following:

- Definition of the type of testing required for each level of hardware and software (above the unit level).
- Presentation of general and specific requirements that will be verified.

NOAA will have the option of witnessing this test and reviewing the informal (non-deliverable) test procedures. Integration testing shall take place at CDA and SOCC separately and jointly. Test procedures shall be validated during this test, including software build and delivery, and any associated database checkout. The development rail shall be used where applicable.

### 3.5.3 Acceptance Test

The Contractor shall develop the Acceptance Test Procedures (F2) and conduct detailed Acceptance Tests. There shall be separate testing for CDA upgrades, SOCC upgrades, and the integrated CSU. All test procedures shall be traced back to the requirement. The verification matrix shall be updated to include the test that verifies the requirement. In the event of deficiencies, the Contractor shall determine suitable resolutions for approval by NOAA. The Contractor shall provide the necessary changes to resolve any deficiencies. The Contractor shall provide Acceptance Test Reports (F3) after each of the CDA, SOCC, and Integrated tests. The 'as run' Test Procedures shall be included in the Test Reports. At the conclusion of test and acceptance of the system, NOAA will notify the Contractor in writing that the system has been accepted.

### 3.5.4 Polar-orbiting Operational Environmental Satellite Ground Segment Verification and Validation

Following successful completion of the CSU Acceptance Test the contractor shall provide on-site support for the NOAA Ground Segment Integrated End-to-End Verification and Validation.

### 3.5.5 Joint Systems Integration Test Support

Joint End-to-End System Testing is performed with EUMESAT following the POES Ground Segment Integrated Verification to verify all interfaces and functionality with the EPS CGS. The Joint End-to-End System Test activities will be determined and documented by NOAA and EUMETSAT. The Contractor shall provide support for the duration of the Joint End-to-End System Tests through the completion of the first METOP satellite commissioning

## 3.6 System Deployment

The Contractor shall locate the SOCC hardware and software source code and executable at Suitland, Maryland in a NOAA designated area. The Contractor shall located CDA

hardware and software executables at Wallops, Virginia and Fairbanks, Alaska. The Contractor shall determine all facility changes needed for the upgrades and shall submit to NOAA all facility requirements for approval, including floor space, air conditioning, electrical power, and safety during system development. These facility requirements shall be presented at the PDR and finalized at the CDR. Contractor shall perform a site survey prior to the PDR.
The Contractor shall document the upgrades by providing change pages to the following PACS documentation:

- On-line Help (N1)
- PACS User's Manual (N2)
- Software Users Manuals (N3)
- Software Build/Delivery Procedures (N4)
- Database Generation/Delivery procedures (N5)
- Software Maintenance Manuals (L1)

The Contractor shall update all hardware system documentation including rack level drawings and cable interconnection drawing (CDRL). The Contractor shall maintain and provide a list of hardware, hardware manuals, operating system manuals, and COTS software manuals delivered to NOAA.

## 3.7 SUSTAINING ENGINEERING

### 3.7.1 Training

The Contractor shall develop a comprehensive Training Class Plan (J1) and shall provide Training Classes. The content and conduct of all training classes shall be based upon the NOAA/NESDIS General Requirements For Training On Electronics Equipment [AD-11]. The classes shall be directed toward government and Contractor personnel, who perform spacecraft mission operations and maintenance, scheduling, spacecraft health and safety monitoring and ground hardware and software maintenance. The Training Class Material (J2) shall cover all aspects of the CSU including newly deployed hardware and software, modifications to existing hardware and software, with special emphasis on new and modified interfaces.
Training shall be provided as a mix of classroom presentation and hands-on activities. All training must take into consideration all shifts. This will require coordination on the part of the Contractor.

### 3.7.2 Hardware Maintenance

The Contractor shall perform hardware maintenance, including repair, on all equipment procured by this contract through the POP of this contract. NOAA will provide GFE in working condition and shall provide maintenance support for GFE that already exists on the current NOAA maintenance contract. Any hardware maintenance support of equipment purchased by the Contractor for these upgrades shall be transitioned to NOAA and/or a NOAA designated Contractor. The Contractor shall provide a recommended list of spares and procure spare equipment identified by the Government in accordance with NOAA/NESDISNESDIS Spare Parts [AD-12].

### 3.7.3 Software Maintenance

The Contractor shall retain full responsibility for the software maintenance following Final Acceptance Test through the POP of this contract. The software maintenance effort includes corrective changes to the software configuration. Documentation updates shall be made as appropriate, to reflect any changes in the PACS User's Manual (N2) and Software Maintenance Manuals (L1). These updates shall be made in accordance with the Software Maintenance and User Documentation sections of the NOAA/NESDIS Software Development, Maintenance, and User Documentation [AD-12].

## 4.0 DELIVERABLES

All hardware shall contain the latest version of firmware within 3 months of delivery to the Government. Quality Assurance procedures shall be applied to all custom hardware, firmware, software, and all upgraded custom software. The procedures shall verify that the software has been tested and documented, at a minimum, with inline comments and prolog. All COTS and Operating System software shall be up-to-date within 3 months of delivery to the government.

Documents shall be delivered per the CDRL and schedule and shall follow the standards specified in the NOAA/NESDIS Document Control Procedure [AD-8]. Appropriate bindings shall be selected for each deliverable. Each document shall be clearly labeled on the cover with its title, document number, date, and version. Each document shall include a document change page form and a document revision history. Text is to be provided on CDROM (preferred) or 3-1/2" PC-compatible diskettes in Microsoft Word 2000 or Word Perfect 9.0. Drawings are to be provided in Visio 2002 format. A request for waiver of electronic delivery will be submitted on a case-by-case basis for documentation not able to be formatted as such. Where appropriate, the Contractor shall provide change pages to existing NOAA documentation.

The specific documents and systems to be delivered to NOAA as part of the performance requirements of the CSU are listed in Table 4.1. The table also indicates the quantity of items to be delivered and the scheduled month for delivery.

SOCC and CDA CDRL
Table 4.1

| CDRL # | Document Title | Copies | | | Deliverable Date |
|---|---|---|---|---|---|
| | | **Hard** | **CD** | **Email** | |
| A1 | Program Status Report | 1 | 0 | Yes | Monthly |
| B1 | Configuration Management Plan | 1 | 4 | | PDR |
| C1 | Meeting Minutes | 1 | 7 | Yes | Mtg +7 days |
| D1 | SOCC CEMSCS ICD | 2<br>2<br>5 | 7<br>7<br>7 | | PDR<br>CDR<br>ATP +30 |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | Days |
| D2 | CDA CEMSCS ICD | 2<br>2<br>5 | 7<br>7<br>7 | | PDR<br>CDR<br>ATP +30 Days |
| D3 | SOCC CDA ICD | 2<br>2<br>5 | 7<br>7<br>7 | | PDR<br>CDR<br>ATP +30 Days |
| E1 | System Description Document (SDD) | 2<br>5 | 7<br>7 | | Prelim-PDR<br>Final-CDR |
| F1 | Acceptance Test Plan | 2<br>5 | 7<br>7 | | Prelim-PDR<br>Final-CDR |
| F2 | Acceptance Test Procedures | 2<br><br>10 | 7<br><br>7 | | Prelim-Test -2weeks<br>Final-Test |
| F3 | Acceptance Test Report | 5 | 7 | | Test +30 days |
| G1 | COTS Selection and Evaluation Report | 5<br>5 | 7<br>7 | | PDR<br>CDR |
| H1 | System Deployment and Installation Plan | 5<br>5 | 7<br>7 | | PDR<br>CDR |
| I1 | Operations and Maintenance Support Plan | 5<br>5 | 7<br>7 | | PDR<br>CDR |
| J1 | Training Class Plan | 5 | 7 | | CDR |
| J2 | Training Class Material | 75 | 7 | | At Class |
| K1 | Software Transition Plan | 5<br>5 | 7<br>7 | | PDR<br>CDR |
| L1 | Software Maintenance Manual | 5 | 7 | | Test + 30 Days |
| M1 | Operator Human Computer Interface (HCI) Analysis | 5 | 7 | | Test + 30 Days |
| N1 | PACS On-line Help | 0 | 7 | | Test + 30 Days |
| N2 | PACS User's Manual | 10 | 10 | | Test + 30 Days |
| N3 | Software Users Manual | 5 | 7 | | Test + 30 Days |
| N4 | Software Build/Delivery Procedures | 5 | 7 | | Test + 30 Days |
| N5 | Database Generation/Delivery Procedures | 5 | 5 | | Test + 30 Days |
| O1 | Preliminary PDR Presentation | 0 | 7 | | PDR -2 wks |
| O2 | Final PDR Presentation | 20 | 7 | | PDR |

| | | | | | |
|---|---|---|---|---|---|
| P1 | Preliminary CDR Presentation | 0 | 7 | | CDR -2 wks |
| P2 | Final CDR Presentation | 20 | 7 | | CDR |

# 5.0 PERIOD OF PERFORMANCE AND SCHEDULE

The CSU will begin upon authorization to proceed and conclude in 24 months with 3 additional option years.

# APPENDIX A

# GLOSSARY

The following is a glossary of acronyms used within this document

| | |
|---|---|
| ACK | Acknowledgment |
| CCSDS | Consultative Committee for Space Systems |
| CDA | Command Data Acquisition |
| CDR | Critical Design Review |
| CDRL | Contract Deliverable Requirement List |
| CDROM | Compact Disk Read Only Memory |
| CEMSCS | Central Environmental Satellite Computer Service |
| CGS | Core Ground Segment |
| CM | Configuration Management |
| COTR | Contract Technical Representative |
| COTS | Commercial Off the Shelf |
| CPU | Central Processing Unit |
| CSU | CDA/SOCC Upgrades |
| DMSP | Defense Meteorological Satellite Program |
| EPS | EUMETSAT Polar System |
| ESA | European Space Agency |
| EUMETSAT | European Organization for the Exploitation of the Meteorological Satellites |
| FCDA | Fairbanks Command and Data Acquisition |
| GAC | Global Area Coverage |
| GDS | Global Data Stream |
| GFE | Government Furnished Equipment |
| HCI | Human Computer Interface |
| ICD | Interface Control Document |
| IJPS | Initial Joint Polar System |
| IPS | Ingest and Preprocessing |
| IMP | Integrated Management Plan |
| ISO | International Organization for Standards |

| | |
|---|---|
| IT | Information Technology |
| Metop | Meteorological Operational Polar satellites of EUMETSAT |
| MHRPT | Metop High Resolution Picture Transmission |
| MHS | Microwave Humidity Sounder |
| NESDIS | National Environmental Satellite, Data, Information Service |
| NOAA | National Oceanic Atmospheric Administration |
| OSD | Office of Systems Development |
| OSO | Office of Satellite Operations |
| PACS | Polar Acquisition and Control Subsystem |
| PDR | Preliminary Design Review |
| PGS | Polar Ground System |
| POES | Polar Orbiting Operational Environmental Satellite |
| POP | Period of Performance |
| QA | Quality Assurance |
| QAP | Quality Assurance Plan |
| RF | Radio Frequency |
| SAIP | Stored Amsu Information Processor |
| SDD | System Description Document |
| SOCC | Satellite Operation Control Center |
| SOMS | Satellite Operations Management Subsystem |
| STIP | Stored Tiros Information Processor |
| TIM | Technical Interchange Meeting |
| TM | Telemetry |
| UTC | Universal Design Review |
| VCDU | Virtual Channel Data Unit |
| VHF | Very High Frequency |
| WCDA | Wallops Command and Data Acquisition |